

# **Central Arizona Water Conservation District**

## **Conceptual Plans to Recover Stored Water**

**DRAFT  
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## TABLE OF CONTENTS

<b>LIST OF TABLES .....</b>	<b>iii</b>
<b>LIST OF FIGURES .....</b>	<b>iii</b>
<b>EXECUTIVE SUMMARY .....</b>	<b>1</b>
<b>1.0 INTRODUCTION.....</b>	<b>4</b>
1.1 PURPOSE OF PLANNING FOR RECOVERY OF STORED CAP WATER .....	4
1.2 SCOPE OF THE PLANNING EFFORT .....	4
1.3 RECOVERY PLANNING PROCESS .....	5
<b>2.0 CURRENT AWBA UNDERGROUND STORAGE CREDITS.....</b>	<b>7</b>
2.1 ARIZONA WATER BANKING AUTHORITY STORAGE PROGRAM .....	7
2.2 MARICOPA COUNTY – PHOENIX AMA AWBA STORAGE CREDITS .....	8
2.3 PINAL COUNTY – PINAL AMA AWBA STORAGE CREDITS AND CAWCD’s MWD CREDITS.....	9
2.4 PIMA COUNTY – TUCSON AMA AWBA STORAGE CREDITS.....	10
<b>3.0 RECOVERY MECHANISMS.....</b>	<b>15</b>
3.1 DIRECT RECOVERY .....	15
3.2 IN-DIRECT RECOVERY .....	15
3.3 CREDIT EXCHANGE RECOVERY .....	16
<b>4.0 ESTIMATED TIMING AND MAGNITUDE OF RECOVERY .....</b>	<b>17</b>
4.1 ESTIMATED TIMING OF RECOVERY .....	17
4.1.1 <i>Interstate Recovery Timing</i> .....	17
4.1.2 <i>On-River P4 Uses Recovery Timing</i> .....	18
4.1.3 <i>CAP M&amp;I Subcontractors Recovery Timing</i> .....	18
4.2 ESTIMATED MAGNITUDE OF RECOVERY .....	18
4.2.1 <i>Magnitude of Interstate Recovery</i> .....	18
4.2.2 <i>Magnitude of On-River and CAP M&amp;I Firming</i> .....	19
4.2.3 <i>Total Estimated Recovery Capacity Requirement</i> .....	19
<b>5.0 CONCEPTUAL RECOVERY PLANS .....</b>	<b>24</b>
5.1 DIRECT RECOVERY CONCEPTUAL PLANS .....	24
5.1.1 <i>Tonopah Region Direct Recovery Plan</i> .....	24
5.1.2 <i>SRP Region Direct Recovery Plan</i> .....	25
5.1.3 <i>Pinal AMA Region Direct Recovery Plan</i> .....	26
5.1.4 <i>Lower Santa Cruz Region Direct Recovery Plan</i> .....	27
5.2 IN-DIRECT CONCEPTUAL RECOVERY PLANS.....	28
5.2.1 <i>Agua Fria Region In-direct Recovery Plan</i> .....	28
5.2.2 <i>SRP Region In-Direct Recovery Plan</i> .....	29
5.2.3 <i>Southeast Phoenix AMA Region In-Direct Recovery Plan</i> .....	29
5.2.4 <i>Pinal AMA Region In-Direct Recovery Plan</i> .....	30
5.2.5 <i>Lower Santa Cruz Region In-Direct Recovery Plan</i> .....	31
5.2.6 <i>Tucson Water Facilities Region In-Direct Recovery Plan</i> .....	32

<b>6.0 COST CONSIDERATIONS AND IMPLEMENTATION STEPS .....</b>	<b>34</b>
6.1 COST CONSIDERATIONS FOR RECOVERY .....	34
6.1.1 <i>Interstate Recovery Cost Considerations</i> .....	34
6.1.2 <i>Firming CAP M&amp;I Subcontract Cost Considerations</i> .....	34
6.1.3 <i>Firming On-River P4 Cost Considerations</i> .....	35
6.2 IMPLEMENTATION STEPS AND “Go/No Go” DECISIONS .....	35
6.2.1 <i>Preparing Detailed Plans</i> .....	35
6.2.2 <i>Implementing Recovery Projects - “Go/No Go” Decision</i> .....	35
6.2.3 <i>Continuing Water Supply and CAP Demands Updates</i> .....	36
<b>APPENDIX A: STAKEHOLDERS LIST .....</b>	<b>37</b>

## **LIST OF TABLES**

<b>Table No.</b>	<b>Description</b>
1	Summary of AWBA Storage Credits

## **LIST OF FIGURES**

<b>Figure No.</b>	<b>Description</b>
1	Map Showing Location Recovery Conceptual Plan Projects
2	Graph Showing Distribution of AWBA Credits
3	Graph Showing Distribution of AWBA Credits for Recovery
4	Map Showing Distribution of AWBA Credits for Recovery
5	Estimated Recovery Schedule for MWD
6	Graph Showing Relationship Between CAP Water Supply, Shortage Triggers, and CAP Water by Priority
7	Graph Showing AWDR Projected Impact of Shortages to On-River P4 Uses and CAP M&I Subcontracts
8	Graph Showing Estimated Recovery Capacity Needs
9	Map Showing Location of Recovery Conceptual Plan Projects

# **CENTRAL ARIZONA WATER CONSERVATION DISTRICT**

## **CONCEPTUAL PLANS TO RECOVER STORED WATER**

### **EXECUTIVE SUMMARY**

A key component of CAP's drought contingency plan is the recovery and use of underground storage credits. The Arizona Water Banking Authority (AWBA) has stored approximately 2.65 million acre-feet (maf) of CAP water underground as storage credits, from 1996 through the end of 2006. CAP staff, in cooperation with the AWBA, is planning to recover approximately 2.126 maf of the stored CAP credits for interstate water banking, firming CAP M&I subcontract water, and firming municipal and industrial users that share CAP's fourth priority for Colorado River water ("on-river P4"). The remaining AWBA credits, approximately .524 maf, are for Indian firming and water management purposes, and outside the scope of this study.

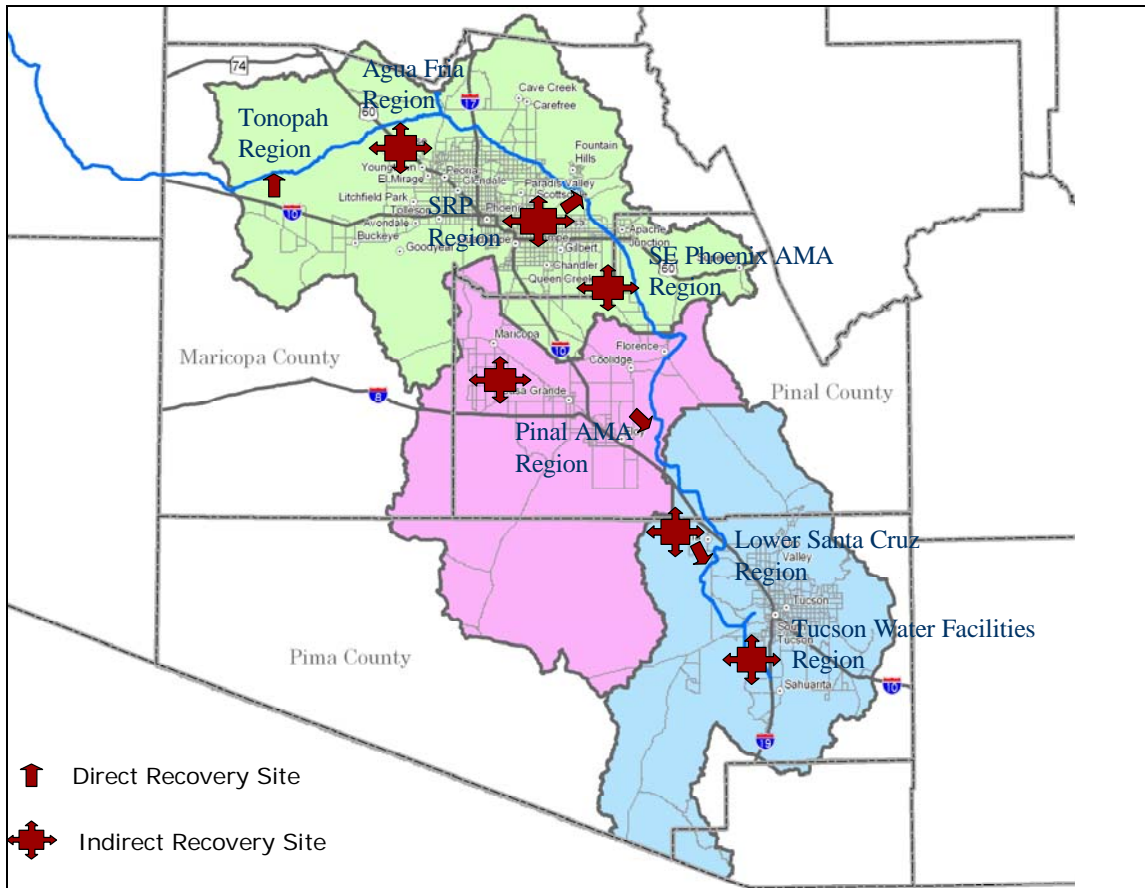
The planning process is composed of four phases: developing conceptual plans, preparing detailed plans including cost-estimates, implementing detailed plans, and reassessing the water supply conditions as necessary. The draft conceptual recovery plans are completed. Detailed plans will be completed in 2009 – 2010 timeframe. Implementation may begin within the 2009 – 2010 timeframe, depending upon water supply conditions.

The draft conceptual plans address recovery for two purposes: interstate recovery for Southern Nevada Water Authority and Metropolitan Water District of Southern California, and intrastate recovery to firm CAP M&I subcontractors' supplies and on-river P4 contractors during times of shortage. Recovery to firm Indian CAP supplies pursuant to the Arizona Water Settlements Act is being addressed separately by the AWBA.

The timing of recovery for M&I firming and on-river P4 firming is directly related to declared shortages of Colorado River water that impact deliveries to CAP M&I subcontractors and on-river P4 uses. Shortages will be determined based guidelines expected to be adopted by the Secretary of the Interior in 2007. The guidelines are anticipated to be based on the water levels in Lake Mead as described in the Basin States alternative. Based on Colorado River modeling, the earliest possible shortage could occur in 2011. However, if average or even slightly below average run-off conditions occur, shortages are not predicted before 2031. Assuming full recovery for M&I firming and on-river P4 uses, the amount of recovery needed to meet demands ranges from 45,000 af/yr to 83,000 af/yr depending upon the timing of shortage. In addition, interstate recovery could range up to 40,000 af/yr. The total recovery demand ranges from 85,000 af/yr to 123,000 af/yr. Adding a 25% contingency factor to the maximum estimated recovery demand yields a recovery capacity requirement of approximately 154,000 af/yr by 2031.

The conceptual plans describe three ways to recover the stored water: direct recovery by pumping stored credits into the CAP canal, indirect recovery by assigning stored credits to a CAP customer as part of their CAP supply, and credit exchange with direct recharge customers. The conceptual plans are defined by the general location of individual recovery projects. The direct recovery conceptual plans include: Tonopah Region, SRP Region, Pinal AMA Region, and the Lower Santa Cruz Region. The conceptual plans for indirect recovery include: the Agua Fria Region, SRP Region, Southeast Phoenix AMA Region, Pinal AMA Region, Lower Santa Cruz Region, and Tucson Water Facilities Region. Credit exchange will be considered with in-direct recovery plans. Figure 1 shows the location of the conceptual recovery plan projects. In addition, the plans reflect input and suggestions received from CAP customers and other stakeholders, from over 30 meetings and workshops. The stakeholders are listed in Appendix A.

The next step in recovery planning is to prepare detailed plans for each of the conceptual plans. The detailed plans will define the optimal recovery capacity, as well as cost estimates for construction, operation and maintenance of recovery facilities. After detailed plans and cost estimates are prepared, likely in 2009/10, CAWCD will decide which recovery projects to implement, based on a continuing reassessment of Colorado River water supplies and CAP demands. Due to the dynamic nature of Colorado River water supply and CAP demands, recovery planning and implementation is expected to be a long-term commitment for CAWCD in terms of staff and financial resources.



**Figure 1 - General Location of Conceptual Recovery Plan Projects**

## **1.0 INTRODUCTION**

### **1.1 PURPOSE OF PLANNING FOR RECOVERY OF STORED CAP WATER**

A key element of the Central Arizona Water Conservation District's (CAWCD) 2006 strategic plan is the development of a drought contingency plan. The primary component of the drought contingency plan is the preparation and implementation of a plan to recover CAP water stored underground, as storage credits. Due to the reduced water supply conditions on the Colorado River system, CAWCD and its customers believe it is timely to prepare for potential shortages of Colorado River water by developing and implementing recovery plans. In addition, due to interstate water banking agreements entered into by the AWBA and CAWCD's operating agreements with the AWBA, it is timely to prepare for recovery for interstate purposes and use recovery planning in the consideration of the AWBA's storage decisions.

The recovery and use of stored CAP will mitigate the impacts of possible shortages of CAP water on CAP's M&I subcontractors and on municipal and industrial users that share CAP's fourth priority for Colorado River water in Arizona ("on-river P4 users"). In addition, recovery of water stored for interstate purposes is essential to the successful operation of interstate water banking agreements with the Southern Nevada Water Authority (SNWA) and the Metropolitan Water District of Southern California (MWD). Recovery planning is a cooperative effort between CAWCD, the Arizona Water Banking Authority (AWBA), and interested stakeholders.

### **1.2 SCOPE OF THE PLANNING EFFORT**

The conceptual plans for recovery of stored water address the recovery of stored CAP water for interstate water banking, to firm CAP M&I subcontracts against shortage, and to firm on-river P4 users. The AWBA is preparing plans to firm Indian CAP water pursuant to the Arizona Water Settlements Act. The Indian firming plans prepared by the AWBA are outside the scope of this study.

The conceptual plans are based on estimated water supplies, water demands, and storage locations from 2007 through 2031. The time frame includes the interim operations period (2008 – 2026) covered by the Record of Decision to be adopted by the Secretary of the Interior in 2007. It is assumed that the Basin States alternative is extended from 20026 through 2031. The storage locations available in 2007 are assumed to be operating and available through 2031, and storage trends continue at existing locations. No new water storage locations are assumed to be available during the period. However, if new storage locations emerge, their storage can be accommodated in the preparation of detailed plans in later stages of recovery planning. The 2031 timeframe shows almost full use of CAP M&I subcontracts and CAP Indian priority uses to illustrate possible impacts of shortages to those uses.



It is assumed that CAWCD will firm the entire volume of shortage to CAP M&I subcontractors using available AWBA storage credits through 2031. It is assumed that the entire volume of on-river P4 uses shortages are firmed through 2031 using available AWBA storage credits. However, the on-river P4 users may elect alternative firming strategies, such as fallowing arrangements with agriculture users, but such arrangements are outside the current scope of this study. In addition, the conceptual plans describe the possible cost components for recovery activities. The actual cost components will be defined through the development of detailed recovery plans.

### **1.3 RECOVERY PLANNING PROCESS**

Recovery planning is a four step process: preparation of conceptual plans, development of detailed plans, implementation of detailed plans, and reassessment of water supply and recovery needs. The conceptual plans are prepared using the following process:

- o Identify the location of current AWBA storage credits. The location of storage credits relative to potential recovery, either delivered directly to the CAP canal or indirectly to CAP users, guides the identification of conceptual plans.
- o Identify the mechanisms for recovering stored water. The mechanisms to recover stored credits are defined by existing laws and agreements. The Arizona storage and recovery statutes (ARS § 45-801 – 898 et seq.), the Storage and Interstate Release Agreement between the United States and the AWBA, and the Agreement to Develop Intentionally Created Unused Apportionment between the AWBA and CAWCD serve to guide the mechanisms currently available for recovery.
- o Define the timing shortages and the triggers for recovery. Because the timing of shortages can directly impact the magnitude of needed recovery capacity, i.e. early shortages may require less recovery capacity because the CAP supplies are not fully utilized for uses requiring firming, the estimated timing of shortages influences the development of conceptual plans. There are three possible triggers for recovery; interstate requests, shortages to CAP, and outages on the CAP system. The timing of interstate requests is based upon discussions with SNWA and MWD. Shortages to CAP are based on the timing of Colorado River shortages. The timing of possible CAP system outages is outside the scope of this study.
- o Define conceptual recovery plans. The conceptual recovery plans match the storage to the recovery mechanisms. The plans identify the general infrastructure and institutional requirements to facilitate recovery of stored water.
- o Receive input from CAP customers. The CAP customers provided comments and preferences regarding recovery mechanism and the components of the conceptual recovery plans.
- o Identify the process to develop detailed plans. Detailed recovery plans are required before cost estimates can be prepared. The cost estimates will be used to compare recovery alternatives to determine the priority for implementing recovery projects.



## **2.0 CURRENT AWBA UNDERGROUND STORAGE CREDITS**

### **2.1 ARIZONA WATER BANKING AUTHORITY STORAGE PROGRAM**

The AWBA has accrued more than 2.650 maf of CAP underground storage credits for the period 1996 through the end of 2006. The AWBA has stored water using four funding sources: General Fund, CAP 4-cent water storage tax, Withdrawal Fees, and interstate water banking. Each funding source has unique constraints for the manner in which the storage credits may be used.

The General Fund storage credits, generated from general funds appropriated by the Arizona Legislature, may be used for firming on-river P4 users, firm CAP M&I subcontractors, aid in settling Indian water rights claims, and the credits may be extinguished to further water management goals. However, the AWBA has established a priority for using the General Fund storage credits. The priority is as follows, from highest to lowest priority; firming on-river P4 uses, aid in settling Indian water rights claims, firm CAP M&I subcontracts, and to fulfill water management objectives. In addition, the AWBA has entered into a contract with the Mohave County Water Authority (MCWA) for recovery of general fund credits to firm their supplies. The AWBA has accrued approximately 396 kaf of underground storage credits with General Fund monies.

The CAP 4-cent tax storage credits, funded from CAP's 4-cent water storage tax, assessed in Maricopa, Pinal, and Pima County, may be used for firming CAP M&I subcontract uses from shortages of Colorado River water or disruption in CAP deliveries. The funds may be used for the benefit of the county in which the funds were collected. In addition, the current law allows that if the AWBA determines that the amount of storage of credits with CAP 4-cent tax funds exceeds the need for firming CAP M&I subcontracts in that particular county, then the credits may be used to firm other surface water supplies experiencing shortage in that county. At present, the AWBA has accrued approximately 1.317 maf of storage credits from CAP 4-cent tax funds.

The Arizona Department of Water Resources (ADWR) collects groundwater withdrawal fees from groundwater users in the Phoenix, Pinal, and Tucson Active Management Area (AMA) that are used to fund water storage by the AWBA. The Withdrawal Fees may be used only to benefit the AMA in which the fees were collected. The stored credits may be used to facilitate Indian water rights settlements or be extinguished to further water management objectives in each AMA. At present, the AWBA has accrued approximately 524 kaf of storage credits from Withdrawal Fees monies.

The AWBA has entered into interstate water banking agreements with the SNWA. The agreement states that the AWBA will make 1.25 maf of underground storage credits available to SNWA for recovery, upon request by SNWA. The maximum annual amount of recovery requested by SNWA is as follows:

- o 20 kaf for 2007 – 08,

- o 30 kaf/yr for 2009 –10, and
- o 40 kaf/yr in 2011 through 2060, or earlier until the credits are fully recovered.

The SNWA will pay the AWBA \$330 million in the aggregate, with \$100 million paid in 2005 into a resources account, and 10 payments annually of \$23 million to an operating account beginning in 2009. The funding is estimated to be sufficient to pay all costs associated with storing sufficient CAP water to meet the AWBA's 1.25 maf obligation. The estimated cost of storage is approximately \$230 million. The \$100 million paid to a resource account is intended to insure that Arizona can meet its obligation. The use of the resource account is at the discretion of the State of Arizona. If the funding is not sufficient to meet the AWBA's 1.25 maf storage credit obligation, the agreement states that the AWBA and SNWA will meet and confer as to whether to reduce the obligation or SNWA will pay for additional water storage. Through the end of 2006, the AWBA has accrued approximately 413 kaf of credits for SNWA, approximately 33% of the 1.25 maf obligation. The current AWBA storage includes 50 kaf stored on behalf of SNWA by CAWCD prior to the creation of the AWBA.

Table 1 summarizes the accrual of storage credits by the AWBA. The table shows the storage credits accrued at each underground storage facility. Figure 2 illustrates the storage at each facility by the funding source for credits.

The conceptual recovery plans focus on recovery of storage credits for CAP M&I firming, firming on-river P4 uses, and interstate water banking operations. Therefore, the conceptual recovery plans do not include recovery capacity for credits stored with Withdrawal Fees monies. The amount of stored credits available for recovery through the conceptual plans is 2.126 maf. The Withdrawal Fees credits may be addressed through the AWBA's Indian firming study or reserved for potential extinguishment for water management purposes. Figure 3 shows the distribution of credits available for recovery through the conceptual plans exclusive of Withdrawal Fees storage.

## **2.2 MARICOPA COUNTY – PHOENIX AMA AWBA STORAGE CREDITS**

The AWBA has earned approximately 1.234 maf of storage credits in Maricopa County and the Phoenix AMA. The storage is located at 12 storage facilities. There are 4 direct underground storage facilities (USF) with AWBA storage credits. They are: Tonopah Desert Recharge Project, Hieroglyphic Mountains Recharge Project, Agua Fria Recharge Project, and the Granite Reef Underground Storage Project (GRUSP). There are 8 groundwater savings facilities (GSF) with AWBA storage credits: Tonopah Irrigation District, Maricopa Water District, Salt River Project, Roosevelt Water Conservation District, Chandler Heights Citrus Irrigation District, Queen Creek Irrigation and Drainage District, New Magma Irrigation and Drainage District, and the Gila River Indian Community Irrigation and Drainage District.

The AWBA has approximately 1.061 maf of credits available for recovery for firming or interstate recovery. The distribution of credits is almost evenly split between GSFs (518 kaf) and USFs (543 kaf). The majority of the CAP M&I firming credits were earned at GRUSP (342 kaf) and New Magma Irrigation and Drainage District (263 kaf). The

Tonopah Desert Recharge Project USF is the only facility with interstate storage in the Phoenix AMA with approximately 24 kaf of interstate storage credits. In general, there are four regional groupings of AWBA water storage:

- o Tonopah Region: Western Maricopa County - includes 1 USF; the Tonopah Desert Recharge Project and 1 GSF; Tonopah Irrigation District. Approximately 100 kaf of storage credits have been earned for recovery in this region.
- o Agua Fria Region: Agua Fria River area - includes 2 USFs; Hieroglyphic Mountains Recharge Project and the Agua Fria Recharge Project, and 1 GSF; Maricopa Water District. Approximately 125 kaf of storage credits have been earned for recovery in this region.
- o Salt River Project Region: Central and eastern Salt River valley - includes 1 USF, GRUSP, and 3 GSFs, Salt River Project, Roosevelt Water Conservation District, and Chandler Heights Citrus Irrigation District. Approximately 484 kaf of storage credits have been earned for recovery in this region. Almost 50% of the AWBA's storage in Maricopa County is in the SRP region.
- o Southeast Phoenix AMA Region: Queen Creek area - includes 3 GSFs, Queen Creek Irrigation and Drainage District, New Magma Irrigation and Drainage District, and the Gila River Indian Community Irrigation and Drainage District. Approximately 352 kaf of storage credits have been earned for recovery in this region.

### **2.3 PINAL COUNTY – PINAL AMA AWBA STORAGE CREDITS AND CAWCD'S MWD CREDITS**

The AWBA has earned approximately 987 kaf of storage credits at four storage facilities in Pinal County. There are no USFs in the Pinal AMA that have AWBA storage credits. There are 4 GSFs that have AWBA storage credits. They are: Hohokam Irrigation and Drainage District (HIDD), Central Arizona Irrigation and Drainage District (CAIDD), Maricopa-Stanfield Irrigation and Drainage District (MSIDD), and the Gila River Indian Community Irrigation and Drainage District.

The AWBA has accrued approximately 714 kaf of storage credits available for recovery, which excludes credits stored with withdrawal fees funds. These credits are stored at three GFS: HIDD, CAIDD, and MSIDD. Approximately 40% of the storage credits are at MSIDD. There are approximately 310 kaf of interstate credits at the three GSFs, which is approximately 75% of all AWBA interstate storage.

Prior to the creation of the AWBA, CAWCD entered into interstate water storage agreements with MWD and SNWA. CAWCD stored 89,000 af of water for MWD, and over 50,000 af for SNWA at MSIDD, CAIDD, and HIDD. CAWCD accrued 80,909 af of storage credits for MWD and 50,000 af of credits for SNWA. The credits for SNWA have been transferred to the AWBA as part of the AWBA interstate water banking

program. In 2007, CAWCD, AWBA and MWD entered into an agreement and CAWCD is recovering a portion MWD's credits in 2007. MWD and SNWA paid for water storage and recovery as part of their storage agreements with CAWCD.

## **2.4 PIMA COUNTY – TUCSON AMA AWBA STORAGE CREDITS**

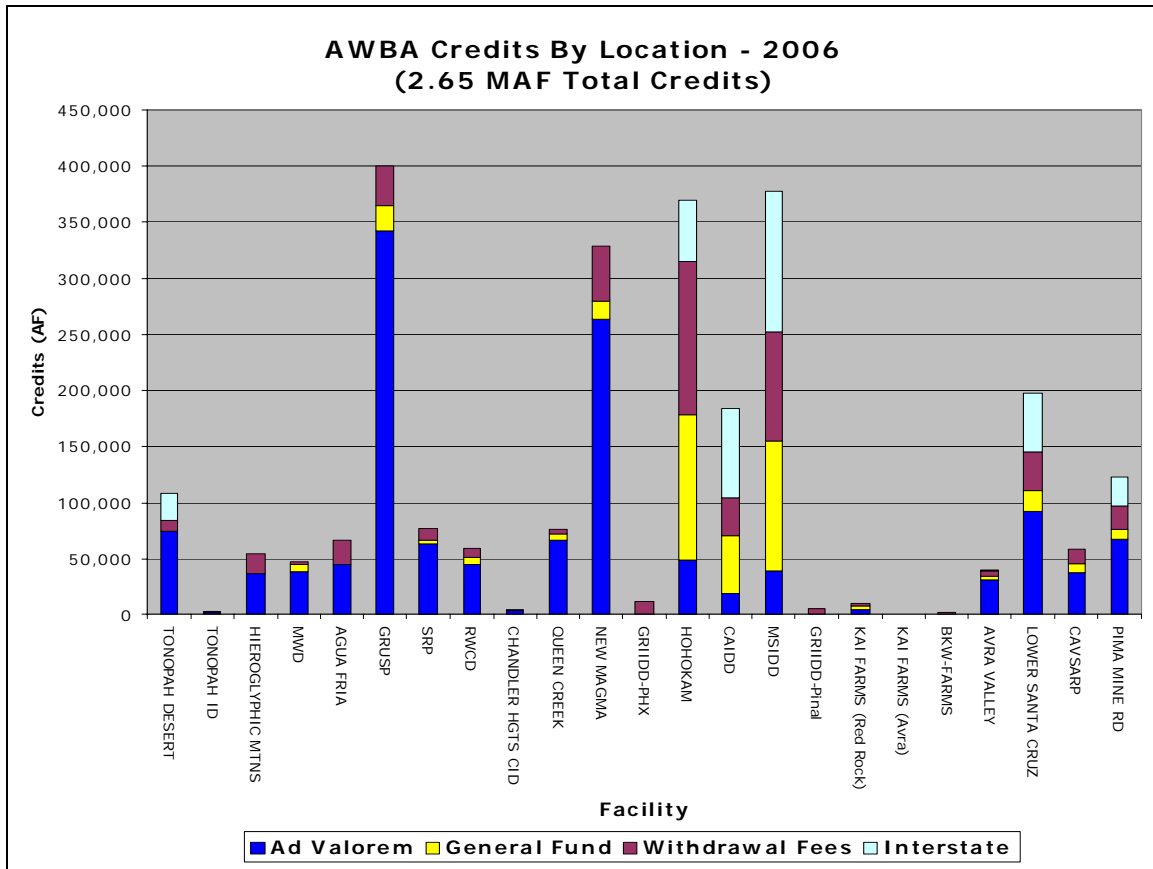
The AWBA has earned approximately 429 kaf of storage credits at 6 storage facilities in the Tucson AMA/Pima County area. The storage is primarily at 4 USFs: Avra Valley Recharge Project (AVRP), Lower Santa Cruz Recharge Project (LSCR), Central Avra Valley Storage and Recovery Project (CAVSRP), and Pima Mine Road Recharge Project (PMRRP). In addition, there are two GSFs with AWBA storage: Kai Farms – Red Rock and BKW Farms.

There are approximately 351 kaf of storage credits available for recovery. Two-thirds of the AWBA's storage in the Tucson AMA is for CAP M&I firming, almost entirely at USFs. There are two regional groupings of AWBA storage in the Tucson area:

- o Lower Santa Cruz Region: Marana area – includes 2 USFs; AVRP and LSCR, and 2 GSFs; Kai Farms and BKW Farms. Approximately 204 kaf of storage credits have been earned for recovery, or approximately 60% of the available credits in the Tucson area.
- o Tucson Water Facilities Region: Central Avra Valley and Pima Mine Road area – includes 2 USFs; CAVSARP and PMRRP. Approximately 147 kaf of storage credits have been earned for recovery in this region.

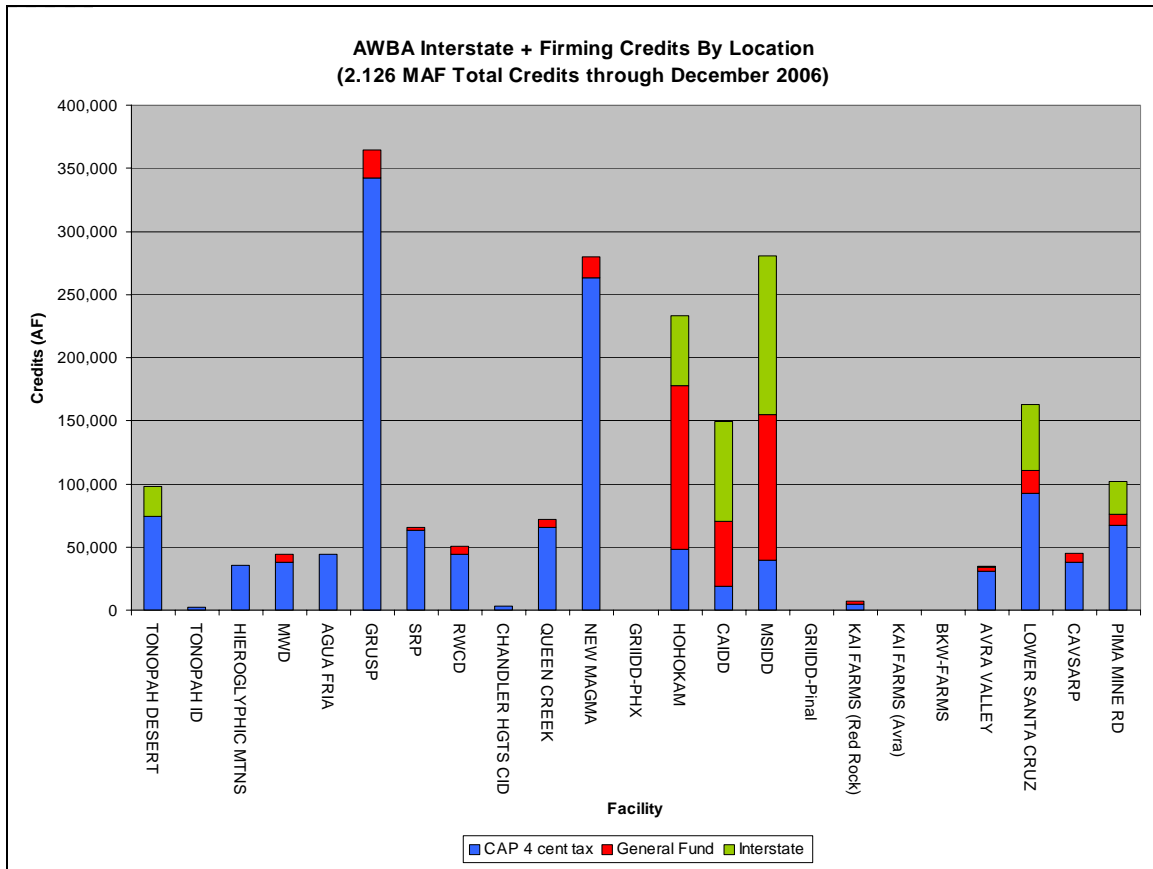
**Table 1 - Summary of AWBA Storage Credits (actuals through 2005 + 2006 estimates)**

<b>AWBA CREDITS (2005 Actuals + 2006 Estimates)</b>						
<b>PHOENIX AMA</b>		<b>General Fund</b>	<b>Withdrawal Fees</b>	<b>CAP 4 cent tax</b>	<b>Interstate</b>	<b>Total Credits</b>
	TONOPAH DESERT	0	9,656	74,180	23,944	107,781
	TONOPAH ID	0	296	2,072	0	2,368
	HIEROGLYPHIC MTNS	0	18,468	35,800	0	54,268
	MWD	6,199	2,849	38,124	0	47,172
	AGUA FRIA	0	21,832	44,655	0	66,486
	GRUSP	21,974	35,483	342,510	0	399,967
	SRP	2,836	11,394	63,097	0	77,327
	RWCD	6,437	7,900	44,238	0	58,575
	CHANDLER HGTS CID	14	1,143	3,357	0	4,513
	QUEEN CREEK	5,928	4,236	65,836	0	76,000
	NEW MAGMA	16,551	48,322	263,478	0	328,351
	GRIIDD-PHX	0	11,523	0	0	11,523
	<b>Total Credits</b>	<b>59,937</b>	<b>173,103</b>	<b>977,348</b>	<b>23,944</b>	<b>1,234,332</b>
<b>PINAL AMA</b>						
	HOHOKAM	129,630	136,598	48,534	55,008	369,770
	CAIDD	51,627	33,837	18,710	79,333	183,507
	MSIDD	115,556	97,170	39,159	126,097	377,982
	GRIIDD-Pinal	0	5,737	0	0	5,737
	<b>Total Credits</b>	<b>296,813</b>	<b>273,341</b>	<b>106,404</b>	<b>310,437</b>	<b>986,996</b>
<b>TUCSON AMA</b>						
	KAI FARMS (Red Rock)	2,305	2,951	4,499	0	9,755
	KAI FARMS (Avra)	0	0	0	0	0
	BKW-FARMS	0	1,386	65	0	1,451
	AVRA VALLEY	3,030	5,148	31,161	265	39,604
	LOWER SANTA CRUZ	18,152	34,407	92,638	52,124	197,321
	CAVSARP	7,529	13,040	37,572	75	58,216
	PIMA MINE RD	8,731	20,488	67,246	26,065	122,530
	<b>Total Credits</b>	<b>39,748</b>	<b>77,420</b>	<b>233,180</b>	<b>78,530</b>	<b>428,877</b>
<b>Total Credits</b>		<b>396,498</b>	<b>523,864</b>	<b>1,316,932</b>	<b>412,911</b>	<b>2,650,205</b>
<b>CAP 4-cent Tax + General Fund + Interstate</b>				<b>GSF</b>	<b>USF</b>	<b>TOTAL</b>
Maricopa Co + PHX AMA				518,166	543,063	1,061,229
Pinal Co + Pinal AMA				713,654	0	713,654
Pima Co + TUC AMA				6,870	344,587	351,457
<b>TOTAL</b>				<b>1,238,690</b>	<b>887,650</b>	<b>2,126,341</b>

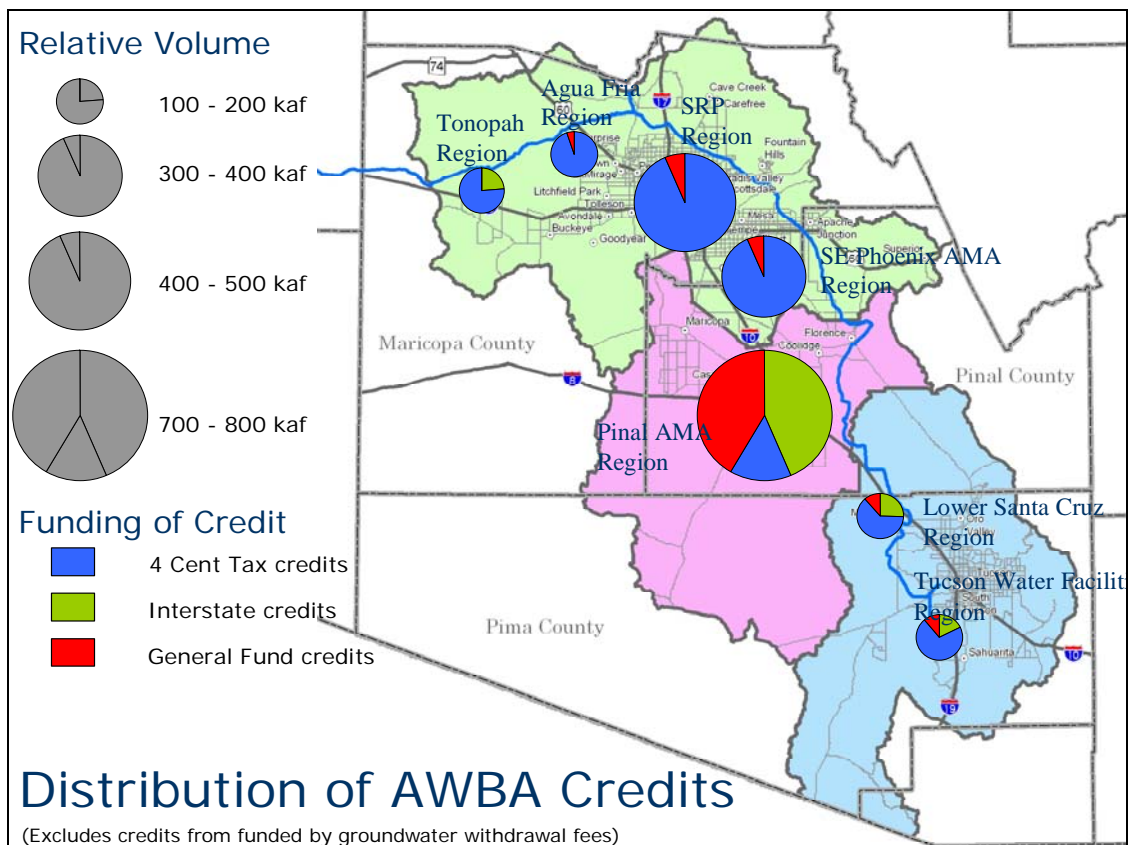


**Figure 2 - Summary of the Distribution of AWBA Storage Credits by Location and Funding Source**





**Figure 3 - Summary of the Distribution of AWBA Storage Credits Available for Recovery by Location and Funding Source**



**Figure 4 - Summary of Regional Distribution of AWBA Storage Credits Available for Recovery**

### **3.0 RECOVERY MECHANISMS**

There are three mechanisms available to recover stored water: Direct, Indirect, and Credit Exchange. The determination of which method is appropriate for a particular facility or location is driven by the physical and economic parameters of recovery, such as depth to groundwater, available groundwater production capacity, groundwater production and delivery costs, and permitting requirements.

By statute, recovery can occur anywhere within the same AMA as the original storage. However, CAP customers have expressed a preference to link recovery to the storage location. Therefore, CAWCD has prepared conceptual plans that are hydraulically linked to the location of storage. In general, this means that the recovery capacity for a conceptual recovery plan will be limited to the storage in the general region of the recovery project. For example, a direct recovery project in the Tonopah Region will be sized to recover storage at the Tonopah Desert Recharge Project and the Tonopah Irrigation District. In the future, CAWCD may consider recovery projects not hydraulically linked to storage locations if such projects meet specific water management goals.

#### **3.1 DIRECT RECOVERY**

Direct recovery describes the recovery of stored credits by pumping groundwater and delivering the groundwater to the CAP canal for delivery as CAP water. Direct recovery requires wells to pump groundwater and pipelines or other conveyance to deliver the recovered water to the CAP canal.

Direct recovery cost components include the operation and maintenance of the recovery wells and conveyance system, as well as the capital costs for construction of the wells and conveyance. In general, direct recovery projects are cost efficient if recovery is adjacent to the CAP canal, and depth to groundwater is relatively shallow. Recovery wells require permits acquired from ADWR. Water quality of recovered water delivered through the CAP system will be managed by CAWCD policies. Increased groundwater pumping adjacent to the CAP canal may raise concerns regarding subsidence.

#### **3.2 IN-DIRECT RECOVERY**

In general, in-direct recovery involves the assignment of storage credits to CAP customers as part of their CAP supply. The CAP customer receives a reduced CAP supply and pumps groundwater storage as part of their CAP supply to replace the reduced CAP water delivery. Indirect recovery is currently underway for recovery of interstate credits for MWD. MSIDD and CAIDD are receiving a reduced CAP supply and pumping stored water from wells to replace the reduced CAP delivery.

In-direct recovery requires a CAP customer to have excess or unused well capacity available to use when CAP deliveries are reduced. In-direct recovery may potentially avoid or reduce possible subsidence impacts by keeping groundwater pumping away from the CAP canal in existing well fields. Indirect recovery cost components include the

reimbursement of the groundwater costs incurred by the CAP customer who pumps groundwater storage as part of their CAP supply. In general, the reimbursement will cover energy costs and well operation and maintenance costs. To the extent new facilities are required to develop additional groundwater capacity for indirect recovery, CAWCD will consider cost sharing alternatives, likely to be developed on a case by case basis. In-direct recovery requires permitted recovery wells, with permits obtained from ADWR. The CAP customer recovering the stored water will manage the quality of recovered water.

### **3.3 CREDIT EXCHANGE RECOVERY**

Credit exchange recovery can occur only at direct recharge facilities. The credit exchange recovery operates when a CAP customer schedules CAP deliveries to a direct recharge facility (USF) for storage, and the AWBA holds credits at the USF. The recovery occurs when the CAP deliveries are reduced to the USF and the AWBA assigns credits from their account to the CAP customer who's storage deliveries are reduced. This mechanism may operate effectively for the CAGRDR or other direct recharge customers.

Credit exchange recovery cost components include the cost of CAP water, borne by the entity receiving the credits. The entity receiving credits at the USF requires a storage permit at the USF.

## **4.0 ESTIMATED TIMING AND MAGNITUDE OF RECOVERY**

The potential timing of recovery for interstate purposes is based upon the request for recovery by SNWA or MWD. MWD has requested recovery for 2007 and CAWCD, along with MSIDD and CAIDD is meeting the request. Recovery for firming requires a shortage of Colorado River water to Arizona. The timing of shortages of Colorado River water is driven by water levels in Lake Mead. The water levels in Lake Mead are largely the result of Colorado River basin run-off, as well as water use trends in the Upper Basin. The magnitude of shortages to CAP and on-river P4 users depends in part on the amount of water used by other Arizona Colorado River users.

### **4.1 ESTIMATED TIMING OF RECOVERY**

The timing of recovery is different for interstate purposes and firming purposes. Interstate recovery is largely at the request of the interstate entity, while firming recovery requires a shortage of Colorado River water for CAP delivery.

#### ***4.1.1 Interstate Recovery Timing***

Interstate recovery is governed by the requests of the interstate banking entities; SNWA and MWD. MWD has a 80,909 af of storage credits stored at the MSIDD, CAIDD, and HIDD GSFs in the Pinal AMA. MWD, per its agreement with CAWCD and AWBA, requested recovery in 2007. CAWCD is recovering for MWD per a recovery schedule for 16,804 af, in 2007, with credits recovered by MSIDD and CAIDD. It is anticipated that MWD will continue to request recovery through 2010 until its storage credits are exhausted. The estimated timing and magnitude of recovery for MWD is shown in Figure 5.

SNWA, per the Agreement for Interstate Water Banking with the AWBA, may request recovery beginning in 2007. Per the agreement, SNWA may request recovery on the following schedule:

- o 2007-08: up to 20,000 af/yr,
- o 2009-10: up to 30,000 af/yr,
- o 2011- 2060: up to 40,000 af/yr, until credits are exhausted.

Discussions with SNWA staff suggest that SNWA will may request a modest amount of recovery before 2011. It is assumed for the purposes of this study, that SNWA requests recovery of 5,000 af in 2009, 15,000 af in 2010, and 40,000 af in 2011. In addition, SNWA may request recovery during shortage conditions. Per the AWBA's agreement, SNWA may request recovery pursuant to the recovery schedule (up to 40,000 af/yr 2011 and beyond) plus recovery sufficient to allow full use of Nevada's 300,000 af consumptive use entitlement. The AWBA may meet the request if it has determined that sufficient recovery capacity is available to meet Arizona's needs and the SNWA request. Further, if a shortage sufficient to cause a reduction in CAP deliveries to CAP M&I and

supplies to on-river P4 domestic uses, SNWA's right to request recovery will be reduced proportionately to the reduction sustained by the CAP M&I subcontractors and the on-river P4 domestic uses. To the extent that SNWA has borne a share of costs to develop recovery capacity, SNWA has a right to request the use of their share of such capacity in the event of a shortage.

#### ***4.1.2 On-River P4 Uses Recovery Timing***

The timing of recovery for on-river P4 uses is directly related to the timing of Colorado River shortages to Arizona. Based on CAWCD's 6/21/2007 Drought Impact Analysis report, the earliest potential onset of shortages could occur in 2011. However, average run-off conditions do not generate shortages to Arizona users. Therefore, from a planning perspective, CAWCD assumes shortages beginning in 2011 and persisting for the entire period study period.

#### ***4.1.3 CAP M&I Subcontractors Recovery Timing***

The timing of recovery for CAP M&I subcontractors is a function not only of shortage conditions on the Colorado River, but also of the use of long-term contract supplies within the CAP, and by other non-CAP Colorado River users in Arizona. So long as 981,901 af of CAP water supplies are available to deliver to long-term CAP M&I subcontract and Indian priority uses in the CAP system, not including higher priority water in the CAP system obtained through prior Indian water rights settlement acts such as the Yuma Mesa water provided in the Ak Chin settlement, then no recovery for CAP M&I firming is required. Based on the analysis of build-up of CAP long-term demands, the timing of shortages, and estimated uses by non-CAP Colorado River users in Arizona, there are no CAP M&I shortages observed in the study period. The analyses are shown in Figure 6. However, even though CAWCD's Drought Impact Analysis shows that CAP M&I firming is unlikely during the study period, for planning purposes, it is assumed that a minimum level of CAP M&I firming is required, beginning in 2025.

## **4.2 ESTIMATED MAGNITUDE OF RECOVERY**

The amount of water to be recovered relates to the type of recovery: interstate and firming, and the magnitude of shortages.

#### ***4.2.1 Magnitude of Interstate Recovery***

Recovery for interstate purposes is governed by existing interstate recovery agreements. The schedule proposed for MWD recovery is shown in Figure 5. The schedule for SNWA is based on the assumption that they request recovery beginning in 2009 and reaching their full amount in 2011. The agreements allow for SNWA to request recovery during a shortage to Arizona. It is assumed that Arizona meets the request for recovery during a shortage. However, since the shortages do not appear to trigger firming for CAP M&I subcontracts, it is assumed that there is no firming to assist SNWA to meet their full Colorado River entitlement.

#### ***4.2.2 Magnitude of On-River and CAP M&I Firming***

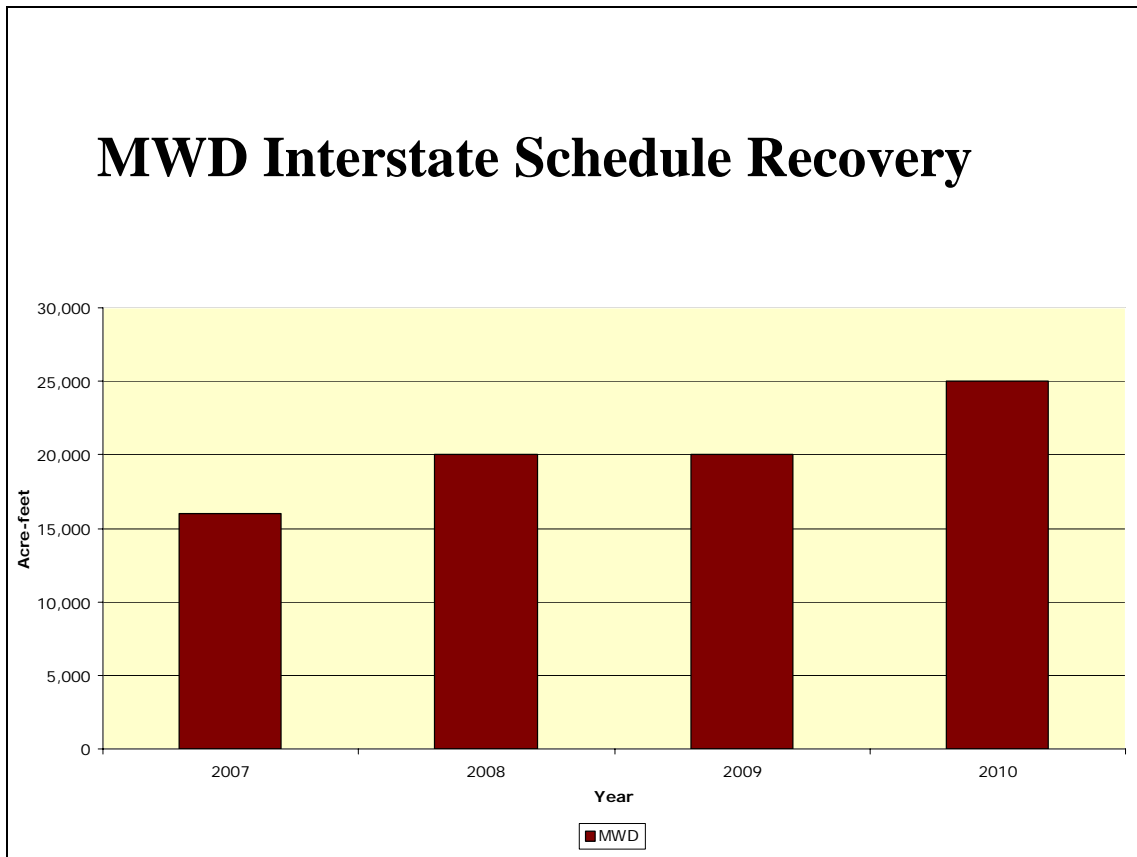
The magnitude of on-river P4 firming and CAP M&I firming is related to the amount of shortage to Arizona uses, the amount of other non-P4 Arizona Colorado River uses and the amount of CAP M&I and Indian priority uses. The degree of shortage, i.e. first, second, or third level shortage triggers, as defined in the shortage guidelines in the ROD to be adopted by the Secretary of the Interior in 2007, indicates the amount of shortage to Arizona. The first shortage trigger requires 320 kaf of shortage to Arizona, while the second shortage trigger requires 400 kaf of shortage to Arizona, and the third shortage trigger requires 480 kaf of shortage to Arizona. The amount of shortage is then shared proportionally between CAP and on-river P4 users, based on their entitlements. In general, on-river P4 users take approximately 10% of Arizona's shortage (32 kaf, 40 kaf, and 48 kaf respectively for level 1, 2, and 3), while CAP receives the remaining 90% of shortage (288 kaf, 360 kaf, and 432 kaf respectively for level 1, 2, and 3).

The potential impacts of shortage trigger levels to CAP uses are shown in Figure 6. In general, shortages to CAP result in reductions to the available excess supply, primarily used by the AWBA, then to full cost excess uses such as CAGR annual replenishment uses, and finally the third shortage trigger results in reductions to CAP's Ag pool supply, and potentially into the Non-Indian Agricultural priority supplies. However, none of these requires CAP M&I firming. In the most conservative case, if it is assumed that higher priority non-CAP Colorado River users accelerate their water uses well beyond their current and historic uses, and all Indian priority and CAP M&I subcontractors accelerate their use of CAP water, then there is a limited potential to reach a CAP M&I firming requirement in a third shortage trigger event. In addition, the analysis shows a modest reduction in Colorado River water available to CAP due to assumed build up of higher priority Arizona Colorado River uses.

Based on analyses by ADWR, the most conservative estimate of on-river P4 firming and CAP M&I firming is shown in Figure 7. The analysis shows the maximum potential firming requirement for on-river P4 and CAP M&I firming is a total of approximately 83 kaf, in the most conservative case at total buildout.

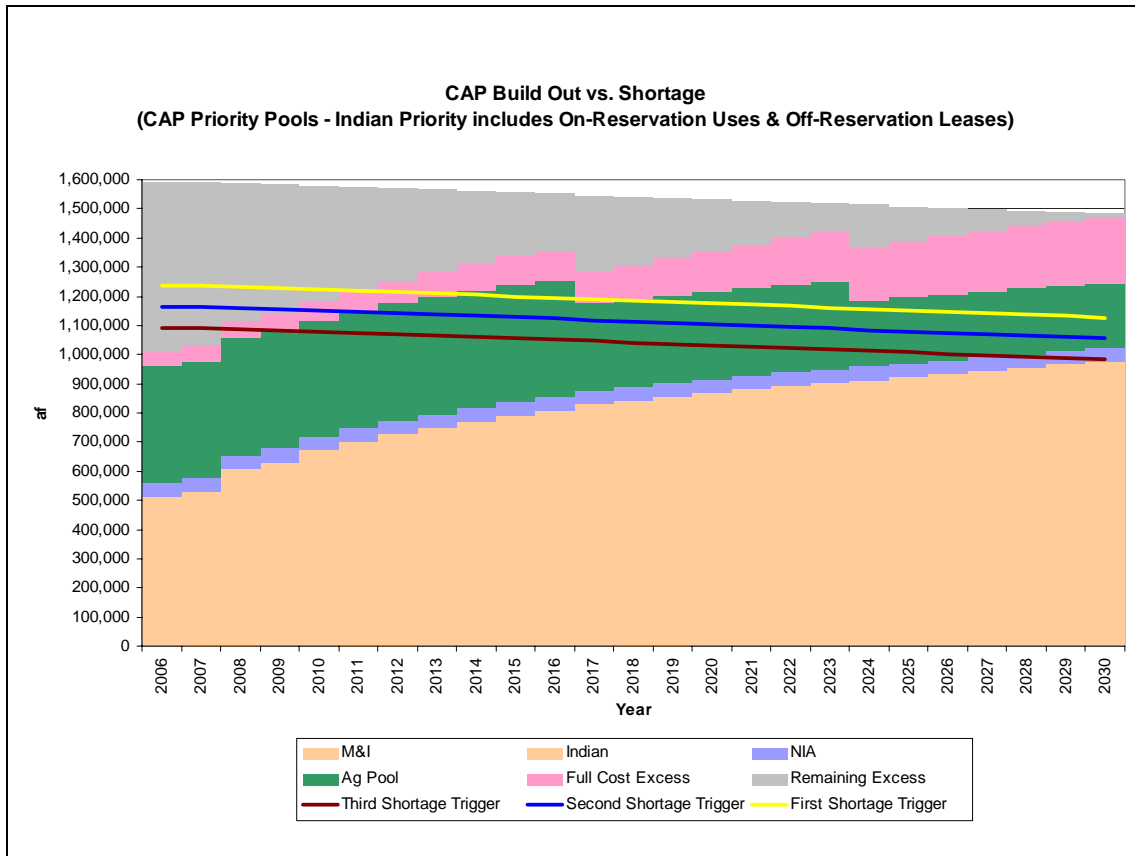
#### ***4.2.3 Total Estimated Recovery Capacity Requirement***

The total estimated recovery capacity requirement is time sensitive based on: requests for recovery for interstate purposes, the build up of CAP and on-river uses, and the timing and magnitude of shortages. The estimated required recovery capacity is shown in Figure 8. The capacity ranges from 16 kaf for interstate in 2007 to 123 kaf in 2030. In addition, actual constructed capacity will likely require additional capacity to cover contingencies and uncertainties, estimated at 25% of required capacity, so that total constructed capacity could reach approximately 154 kaf.



**Figure 5 MWD Interstate Recovery Schedule**





**Figure 6 Relationship Between Shortage Triggers and CAP Water Uses By Priority**

## ADWR's Estimate of Arizona Shortages

		320 kaf	400 kaf	480 kaf	
2016	P4 On-River*	28.3	36.8	45.3	67.3kaf
	CAP M&I**	0	0	0 to 22.0	
2025	P4 On-River	31.9	40.4	48.9	76.9kaf
	CAP M&I	0	0	0 to 28.0	
~ 2030	P4 On-River	33.4	42.0	50.6	83.0kaf
	CAP M&I	0	0	0 to 32.4	

\*ADWR P4 Shortage Sharing Agreement Analysis, includes conservative (HIGH) estimate of on-river uses.

\*\* Maximum Shortage Assumes **FULL USE** of Long-term CAP M&I and Indian Priority water.

**Figure 7 ADWR Estimate of Maximum Recovery Requirement**

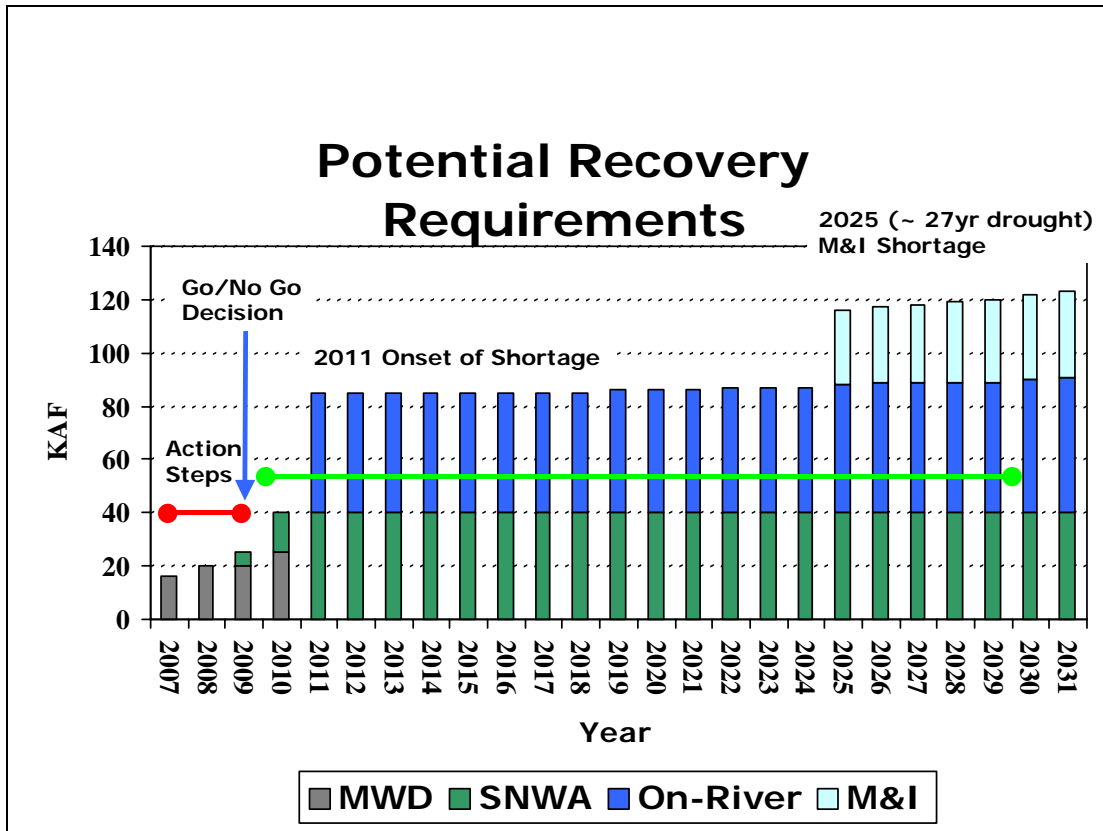


Figure 8 Potential Recovery Requirements

## **5.0 CONCEPTUAL RECOVERY PLANS**

The development of conceptual recovery plans relates the location of storage to the practical opportunities to recover the stored water in the most efficient manner, based on available concept level information. In several cases, there are opportunities to recovery directly, in-directly, or through credit exchange from the same region. The conceptual plans provide the framework for developing detailed plans, to be used for implementation decisions. There are four direct recovery conceptual plans and six in-direct recovery plans. Credit exchange opportunities will be evaluated with the in-direct recovery plans. The locations of the conceptual plans are illustrated in Figure 9.

### **5.1 DIRECT RECOVERY CONCEPTUAL PLANS**

There are four direct recovery conceptual plans described below. The direct recovery conceptual plans are focused on recovering storage to the CAP canal system for delivery as part of the CAP supply. The direct recovery conceptual plans may be used for interstate as well as firming purposes.

#### ***5.1.1 Tonopah Region Direct Recovery Plan***

The Tonopah Region Recovery Plan focuses on recovering storage at the Tonopah Desert Recharge Project (TDRP) and the Tonopah Irrigation District (TID) storage facilities. The concept for a recovery project is to locate a recovery wells in western Maricopa County, on or adjacent to the TDRP site and deliver the recovered water to the CAP canal. CAWCD owns and operates the TDRP. The TDRP facility is approximately 6 miles northwest of Tonopah, in the Hassayampa sub-basin of the Phoenix AMA. The site occupies 542 acres of land adjacent to the CAP canal west of Lake Pleasant. The project, constructed and operated by CAP, includes 19 infiltration basins with a combined surface area of 207 acres. The facility has an operational capacity of greater than 130,000 acre-feet per year. The project has operated since 2006 and has stored approximately 132,000 acre-feet of CAP water through the end of 2006. The AWBA has accrued approximately 100,000 acre-feet of storage credits at the facility through 2006. The TID groundwater savings facility is approximately 3 miles east of the TDRP facility and has approximately 2,000 af of storage by the AWBA to date.

Direct recovery at Tonopah requires installation of recovery wells and conveyance pipelines to the CAP canal. Data developed during the project permitting suggest that large capacity recovery wells could yield from 1,000 gpm to 1,500 gpm, or a maximum of approximately 1,600 to 2,400 af/yr. At present, there are no CAP M&I subcontractor service areas within 1 mile from the exterior boundary of the facility.

To estimate the potential recovery capacity and possible costs for direct recovery from the Tonopah Region, additional detailed plans are necessary. The additional detailed plans include:

- Groundwater recovery capacity study: A study to estimate the location of stored water and the optimal recovery capacity available at the site.

- Recovery well design and permitting: Based on the optimal recovery well capacity, prepare recovery well designs and recovery well permits.
- Design pipeline conveyance system to the CAP canal: Prepare designs for the system to convey recovered water from the recovery wells to the CAP canal.
- Prepare estimated construction and development timeline.
- Prepare cost estimates for recovery: including construction estimates and operation and maintenance costs.

### ***5.1.2 SRP Region Direct Recovery Plan***

The SRP Region Direct Recovery Plan focuses on recovering storage at the the Granite Reef Underground Storage Project (GRUSP). GRUSP is a direct recharge facility located in the eastern Salt River Valley groundwater basin, in the Salt River channel just west of the Granite Reef Diversion Dam. SRP owns and operates GRUSP. The facility is located on Salt River Pima Maricopa Indian Community (SRPMIC) lands. The recovery concept is to locate a direct recovery project adjacent to or within the GRUSP site. The GRUSP site comprises approximately 217 acres with 7 infiltration basins. The facility has an operational capacity of approximately 100 kaf/yr. The project has been operational since 1994 and has stored 400 kaf for the AWBA, of which approximately 364 kaf is primarily for firming recovery.

Direct recovery near GRUSP requires installation of recovery wells and conveyance pipelines and possibly a lift station to deliver recovered water to the CAP canal. Available data suggests large capacity recovery wells could yield from 1,000 to 2,000 gpm or a maximum of approximately 1,600 af/yr to 3,200 af/yr. There are several CAP M&I subcontractors near GRUSP including Mesa, Scottsdale, and Phoenix.

To estimate the potential recovery capacity and possible costs for direct recovery from the SRP Region, GRUSP area, additional studies and planning efforts are necessary. The additional studies will be cooperative efforts with SRP and interested SRP shareholders. These additional efforts may include:

- Groundwater recovery capacity study: A study to estimate the location of stored water and the optimal recovery capacity available at the GRUSP site. The groundwater recovery capacity may include estimates of the timing and magnitude of shortages on the SRP system and the impacts of increased SRP pumping on recovery at GRUSP.
- Recovery well design and permitting: Based on the optimal recovery well capacity, prepare recovery well designs and recovery well permits.
- Design pipeline conveyance system to the CAP canal: Prepare designs for the system to convey recovered water from the recovery wells to the CAP canal and identify rights of way.
- Evaluate legal and institutional issues regarding recovery from the SRP service

area for use in the CAP system and issues relating to SRPMIC lands.

- Prepare cost estimates for recovery: including construction estimates and operational and maintenance costs.
- Prepare construction and development timeline.
- Develop concept level framework agreements for direct recovery and conveyance from GRUSP to the CAP system.

### ***5.1.3 Pinal AMA Region Direct Recovery Plan***

The Pinal AMA Region Direct Recovery Plan requires the development of recovery wells in the Pinal AMA to deliver recovered water to the CAP canal or Santa Rosa canal. Recovered water can be delivered to the CAP system or to the Santa Rosa to deliver to the Ak Chin Indian Community in times of shortage. The three irrigation districts in the Pinal AMA have stored over 987 kaf for the AWBA, of which approximately 725 kaf will be recovered for firming or interstate purposes.

Direct recover in the Pinal AMA region will require installation of new wells and conveyance to the CAP canal or the Santa Rosa canal. Portions of the Pinal AMA have large capacity wells ranging from 1,000 to 2,000 gpm wells or a maximum production of 1,600 af/yr to 3,200 af/yr. It is assumed that new recovery wells would yield equivalent production. CAP M&I subcontractors in the Pinal AMA include: Eloy, Casa Grande, Florence, and Coolidge.

Preparing detailed plans to implement a Pinal AMA direct recovery project requires additional studies. These studies include:

- Groundwater recovery well field siting study. A study to identify optimal locations for new groundwater pumping in the Pinal AMA. The optimal location will be determined by an evaluation of aquifer parameters, groundwater elevation, adjacent groundwater uses, land ownership, and distance from the CAP or Santa Rosa canal. The siting study will also consider institutional restrictions on groundwater pumping from Indian water rights settlements and other agreements.
- Groundwater recovery capacity study: A study to estimate the optimal recovery capacity available at a recovery well field. The groundwater recovery capacity may include estimates of the relationship of the recovery well field to the location of stored water.
- Recovery well design and permitting: Based on the optimal recovery well capacity, prepare recovery well designs and recovery well permits.
- Design pipeline conveyance system to the CAP or Santa Rosa canal: Prepare designs for the system to convey recovered water from the recovery wells to the CAP or Santa Rosa canal, and identify rights of way.
- Prepare construction and development timeline.

- Evaluate legal and institutional issues regarding recovery in the Pinal AMA.
- Prepare cost estimates: including construction costs and operation and maintenance costs of pumping and delivering groundwater.

#### ***5.1.4 Lower Santa Cruz Region Direct Recovery Plan***

The Lower Santa Cruz Region Direct Recovery Plan focuses on recovering storage from the Lower Santa Cruz (LSCR) and Avra Valley Recharge Projects (AVRP), and the BKW and Kai Farms groundwater savings facilities. The recovery concept is to locate direct recovery wells in the vicinity of the LSCR and the AVRP storage and recover the stored water to the CAP canal. CAWCD owns and operates the AVRP and LSCR. The LSCR and AVRP are located in the Marana area of the Tucson AMA. The projects occupy approximately 41 acres and have 7 infiltration basins. The AVRP facility began operations in 1996 and the LSCR began operations in 2000. The AWBA has stored a total of approximately 237 kaf at the LSCR and AVRP, of which approximately 199 kaf is for firming or interstate purposes. In addition, there are approximately 7 kaf stored for recovery purposes at the groundwater savings facilities.

Direct recovery at the Lower Santa Cruz Region requires installation of recovery wells and conveyance facilities to the CAP canal. Available data suggests that large capacity wells in the region can yield from 1,000 gpm to 1,500 gpm, or a maximum of 1,600 af/yr to 2,400 af/yr. The CAP M&I subcontractors in the region include: Marana, Metropolitan Domestic Water Improvement District, Flowing Wells Irrigation District, and Oro Valley. Tucson is the largest CAP water user downstream of the Lower Santa Cruz region.

To prepare detailed direct recovery plans for the Lower Santa Cruz Region additional studies are necessary. These additional studies include:

- Groundwater recovery capacity study: A study to estimate the location of stored water and the optimal recovery capacity available at the Lower Santa Cruz Region. The groundwater recovery capacity may include estimates of the impacts of development and potential increases in groundwater pumping in the region, as well as impacts to sensitive areas such as the Tangerine Landfill.
- Recovery well design and permitting: Based on the optimal recovery well capacity, prepare recovery well designs and recovery well permits.
- Design pipeline conveyance system to the CAP canal: Prepare designs for the system to convey recovered water from the recovery wells to the CAP canal and identify rights of way.
- Prepare construction and development timeline.
- Evaluate legal, institutional, and jurisdictional issues regarding recovery from the Lower Santa Cruz Region.

- Prepare cost estimates: including construction costs and operation and maintenance costs.

## **5.2 IN-DIRECT CONCEPTUAL RECOVERY PLANS**

There are six in-direct recovery conceptual plans described below. In-direct recovery plans describe the assignment of storage credits to CAP users who use the credits to pump additional groundwater to replace a reduction in CAP deliveries. In-direct recovery is the method being used to recover interstate storage in 2007 and may be used for firming recovery as well. Credit exchange may be a component of in-direct recovery plans.

### ***5.2.1 Agua Fria Region In-direct Recovery Plan***

The Agua Fria Region In-direct recovery plan is for recovering storage from the Agua Fria Recharge Project (AFRP), Hieroglyphic Mountains Recharge Project (HMRP), and the Maricopa Water District groundwater savings facility. The region is located in the Agua Fria River corridor area in the western portion of the Salt River Basin. The AWBA has stored 167 kaf of credits in the region, of which approximately 125 kaf are for firming or interstate purposes. CAWCD owns and operates the AFRP and HMRP and the City of Peoria owns 15% of the storage capacity at the facilities.

In-direct recovery in the Agua Fria Region requires the assignment of storage credits to CAP water users with sufficient groundwater production capacity to recover the credits to replace reductions in CAP water deliveries. CAP M&I subcontractors in the region include: Peoria, Arizona American Water Company, Glendale, Surprise, Avondale, and CAGRD.

To investigate in-direct recovery in the Agua Fria Region, additional studies are necessary. These additional studies may include cooperative efforts with CAP water users in the region. The additional studies include:

- Groundwater recovery capacity study: A study to estimate the location of stored water relative to existing and planned groundwater uses by CAP customers in the region. The study may update existing geologic and hydrologic parameters.
- Identify partners for in-direct recovery based on their current and future groundwater production and use plans.
- Evaluate credit exchange mechanism.
- Define additional infrastructure needs for in-direct recovery by identified partners.
- Prepare development timeline.
- Evaluate legal, institutional, and jurisdictional issues regarding in-direct recovery from the Agua Fria Region.



- Prepare concept level framework agreements for in-direct recovery with identified partners, including cost components.

### ***5.2.2 SRP Region In-Direct Recovery Plan***

The SRP Region In-direct recovery plan is for recovering storage from GRUSP, SRP groundwater savings facility, the Roosevelt Water Conservation District (RWCD), and the Chandler Heights Citrus Irrigation District (CHCID). The region includes the SRP service area, and the RWCD in the eastern portions of the Salt River Basin in the Pheonxi AMA. The AWBA has stored over 525 kaf of credits in the region, of which approximately 484 kaf are for firming or interstate purposes.

In-direct recovery in the SRP Region requires the assignment of storage credits to CAP water users with sufficient groundwater production capacity to recover the credits to replace reductions in CAP water deliveries. The conceptual plan includes the possibility of recovery pumping by SRP and conveyance to CAP users through the SRP system. CAP M&I subcontractors in the region include: Phoenix, Scottsdale, Tempe, Mesa, Peoria, Arizona American Water Company, Glendale, Chandler, Gilbert, Surprise, Arizona Water Company, Avondale, and CAGRD.

To investigate in-direct recovery in the SRP Region, additional studies are necessary. These additional studies may include cooperative efforts with CAP water users in the region. The additional studies include: :

- Groundwater recovery capacity study: A study to estimate the location of stored water relative to existing and planned groundwater uses by CAP customers in the region. In addition, an evaluation of possible additional groundwater pumping by SRP in response to shortages in SRP supplies may be necessary. The study may update existing geologic and hydrologic parameters.
- Identify partners for in-direct recovery based on their current and future groundwater production and use plans, including SRP pumping and conveyance.
- Evaluate credit exchange mechanisms.
- Define infrastructure needs for in-direct recovery by identified partners, including potential delivery through the SRP system, which may require modifications or additions to the SRP system.
- Prepare development timeline.
- Evaluate legal, institutional, and jurisdictional issues regarding in-direct recovery from the SRP Region.
- Prepare concept level framework agreements for in-direct recovery with identified partners, including cost components.

### ***5.2.3 Southeast Phoenix AMA Region In-Direct Recovery Plan***

The Southeast Phoenix AMA Region In-direct recovery plan is for recovering storage from the Queen Creek Irrigation and Drainage District (QCIDD), and the New Magma

Irrigation and Drainage District (NMIDD). At present, storage at the Gila River Indiance Community groundwater savings facility is for withdrawal fees and possibly Indian firming and outside the scope of this conceptual plan. The region occupies the southeastern portion of the Phoenix AMA, mainly in the Queen Creek area. The AWBA has stored over 400 kaf of credits in the region, of which approximately 352 kaf are for firming or interstate purposes.

In-direct recovery in the Southeast Phoenix AMA Region requires the assignment of storage credits to CAP water users with sufficient groundwater production capacity to recover the credits to replace reductions in CAP water deliveries. CAP M&I subcontractors in the region include: Mesa, Chandler, Gilbert, Arizona Water Company, and CAGR. D.

To investigate in-direct recovery in the Southeast Phoenix AMA Region, additional studies are necessary. These additional studies may include cooperative efforts with CAP water users in the region, including the East Valley Water Forum. The additional studies include:

- Groundwater recovery capacity study: A study to estimate the location of stored water relative to existing and planned groundwater uses by CAP customers in the region. The study may update existing geologic and hydrologic parameters.
- Identify partners for in-direct recovery based on their current and future groundwater production and use plans.
- Evaluate credit exchange mechanisms.
- Define infrastructure needs for in-direct recovery by identified partners.
- Prepare development timeline.
- Evaluate legal, institutional, and jurisdictional issues regarding in-direct recovery from the Southeast Phoenix AMA Region.
- Prepare concept level framework agreements for in-direct recovery with identified partners, including cost components.

#### ***5.2.4 Pinal AMA Region In-Direct Recovery Plan***

The Pinal AMA Region In-direct recovery plan is for recovering storage from Maricopa Stanfield Irrigation and Drainage District (MSIDD), the Central Arizona Irrigation and Drainage District (CAIDD), and the Hohokam Irrigation and Drainage District (HIDD). The AWBA has stored over 987 kaf of credits in the region, of which approximately 725 kaf are for firming or interstate purposes.

In-direct recovery in the Pinal AMA Region requires the assignment of storage credits to CAP water users with sufficient groundwater production capacity to recover the credits to replace reductions in CAP water deliveries. At present, in-direct recovery for interstate recovery is on-going with MSIDD and CAIDD. These districts are using credits as part of their groundwater production to make up for a reduction in CAP deliveries to make

water available for interstate recovery. In general, in-direct recovery may not be available in large volumes from the irrigation districts during a shortage to CAP because the irrigation districts may require a majority of their groundwater capacity for irrigation. CAP M&I subcontractors in the region include: Casa Grande, Eloy, Coolidge, and Florence.

To investigate in-direct recovery in the Pinal AMA Region, additional studies are necessary. These additional studies may include cooperative efforts with CAP water users in the region. The additional studies include :

- Groundwater recovery capacity study: A study to estimate the location of stored water relative to existing and planned groundwater uses by CAP customers in the region. In addition, an evaluation of possible additional groundwater pumping by the irrigation districts in response to shortages in available CAP supplies may be necessary. The study may update existing geologic and hydrologic parameters.
- Identify partners for in-direct recovery based on their current and future groundwater production and use plans, including irrigation district pumping and conveyance.
- Evaluate credit exchange mechanisms.
- Define infrastructure needs for in-direct recovery by identified partners.
- Prepare development timeline.
- Evaluate legal, institutional, and jurisdictional issues regarding in-direct recovery from the Pinal AMA Region.
- Prepare concept level framework agreements for in-direct recovery with identified partners, including cost components.

#### ***5.2.5 Lower Santa Cruz Region In-Direct Recovery Plan***

The Lower Santa Cruz Region In-direct recovery plan is for recovering storage from LSCR, AVRP, BKW and Kai Farms groundwater savings facilities. The region includes the Marana area of the Tucson AMA. The AWBA has stored almost 250 kaf of credits in the region, of which approximately 206 kaf are for firming or interstate purposes.

In-direct recovery in the Lower Santa Cruz Region requires the assignment of storage credits to CAP water users with sufficient groundwater production capacity to recover the credits to replace reductions in CAP water deliveries. CAP M&I subcontractors in the region include: Marana, Oro Valley, Flowing Wells Irrigation District, and Metropolitan Domestic Water Improvement District.

To investigate in-direct recovery in the Lower Santa Cruz Region, additional studies are necessary. These additional studies may include cooperative efforts with CAP water users in the region. The additional studies include:

- Groundwater recovery capacity study: A study to estimate the location of stored water relative to existing and planned groundwater uses by CAP customers in the region. The study may update existing geologic and hydrologic parameters.
- Identify partners for in-direct recovery based on their current and future groundwater production and use plans.
- Evaluate credit exchange mechanisms.
- Define infrastructure needs for in-direct recovery by identified partners.
- Prepare development timeline.
- Evaluate legal, institutional, and jurisdictional issues regarding in-direct recovery from the Lower Santa Cruz Region.
- Prepare concept level framework agreements for in-direct recovery with identified partners, including cost components.

#### ***5.2.6 Tucson Water Facilities Region In-Direct Recovery Plan***

The Tucson Water Facilities Region In-direct recovery plan is for recovering storage from Tucson Water underground storage facilities: Central Avra Valley Storage and Recovery Project (CAVSARP) and Pima Mine Road Recharge Project (PMRRP). The PMRRP is jointly owned by CAWCD and Tucson and is operated consistent with the IGA between CAWCD and Tucson. While the region includes the Tucson water service area in the Tucson AMA, the conceptual recovery plan focuses on the areas on or adjacent to the two storage facilities. The AWBA has stored approximately 160 kaf of credits in the region, of which approximately 147 kaf are for firming or interstate purposes.

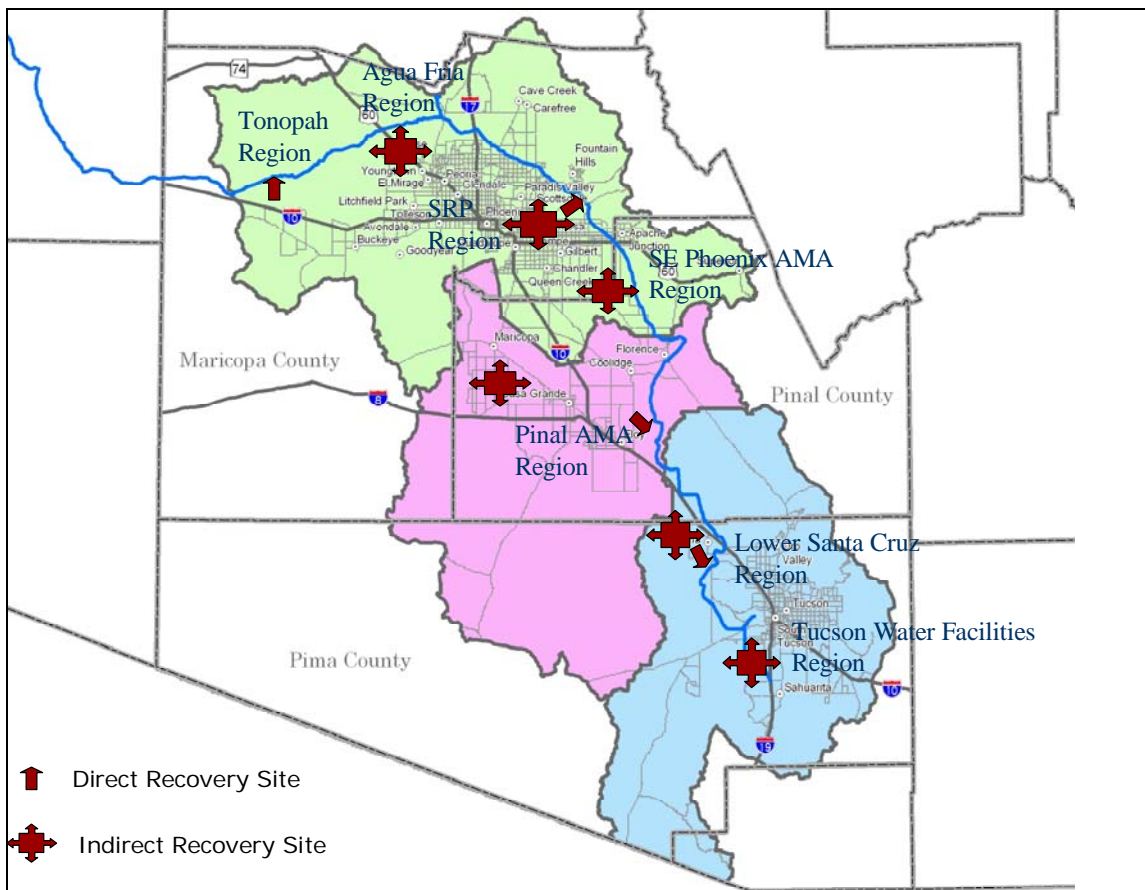
In-direct recovery in the Tucson Water Facilities Region requires the assignment of storage credits to the CAP water users, principally the City of Tucson, with sufficient groundwater production capacity to recover the credits to replace reductions in CAP water deliveries. The principal CAP M&I subcontractor in the region is the City of Tucson.

To investigate in-direct recovery in the Tucson Water Facilities Region, additional studies are necessary. These additional studies will likely be cooperative efforts with the City of Tucson. The additional studies include :

- Groundwater recovery capacity study: A study to estimate the location of stored water relative to existing and planned groundwater uses by the City of Tucson and other water users in the area. In addition, a detailed evaluation of the potential duration of shortages of Colorado River water and the potential impacts of long-term drought on the City of Tucson's groundwater production capability may be necessary. The study may update existing geologic and hydrologic parameters.
- Define possible infrastructure needs for in-direct recovery by the City of Tucson,

both in terms of increased storage capacity and recovery and conveyance capacity. An assessment of groundwater production needs of the City adjacent to PMRRP may be necessary.

- Evaluate credit exchange mechanisms.
- Prepare development timeline.
- Evaluate potential legal, institutional, and jurisdictional issues regarding in-direct recovery from the Tucson Water service area.
- Prepare concept level framework agreements for in-direct recovery with the City of Tucson, including cost components.



**Figure 9 - General Location of Conceptual Recovery Plan Projects**

## **6.0 COST CONSIDERATIONS AND IMPLEMENTATION STEPS**

The determination of the most efficient methods to recover stored water includes the consideration of the costs of recovery. In addition, in order to move forward with the preparations to recover stored water, implementation steps are outlined.

### **6.1 COST CONSIDERATIONS FOR RECOVERY**

There are multiple aspects to recovery costs depending upon the purpose of the recovery. Interstate recovery costs are generally borne by SNWA and MWD, while firming recovery costs are borne by CAP customers or on-river P4 users.

#### ***6.1.1 Interstate Recovery Cost Considerations***

In general, recovery costs for interstate purposes are assigned to the interstate water banking partner i.e. SNWA. These costs include energy, O&M, and a contribution to capital for recovery facilities. However, for MWD storage and the first 50 kaf of SNWA, the entities prepaid for recovery. Therefore, no additional charges are assigned to MWD for the entire amount of recovery (80,909 af) or the first 50 kaf of recovery for SNWA. The prepaid recovery fees are sufficient to cover current recovery costs to CAWCD for using in-direct recovery methods with MSIDD and CAIDD. When recovery projects are completed that provide recovery for interstate purposes, the interstate partner will pay their appropriate share of the capital cost of the facility. CAWCD, in cooperation with the facility owner and the AWBA, will develop a cost sharing approach for each recovery project used for interstate purposes.

#### ***6.1.2 Firming CAP M&I Subcontract Cost Considerations***

During a shortage to CAP M&I subcontracts, CAWCD intends to recover the amount of storage necessary to meet all CAP M&I subcontract demands at that time. In general, CAP M&I subcontracts will pay for and receive their scheduled amount of water, up to their subcontract entitlement. If entities elect to provide in-direct recovery to CAWCD, they will pump a portion of the CAP water from their wells.

During a shortage, the CAP water delivery rate will likely reflect the mix of recovery methods used to firm the CAP M&I subcontracts as well as costs to divert and deliver Colorado River water. For example, the rate will reflect the costs to develop, operate, and maintain direct recovery capacity (wells) and the costs to CAWCD to pay for in-direct recovery services provided by some CAP customers. Costs to CAWCD for in-direct services will generally include energy for groundwater production and O&M costs. Estimates of recovery costs components will be developed along with the detailed recovery plans in the next step of the recovery planning process.

Fixed O&M costs for CAP water could increase due to a shortage because of a reduction in water deliveries. However, the CAWCD Board, in its rate setting process, has flexibility on the collection and use of CAWCD revenues, in particular the ad valorem tax revenues and water storage tax revenues. Issues relating to setting water rates to prepare for and during a shortage to CAP will likely require substantial discussion and consideration by the CAWCD Board and CAP customers.

### ***6.1.3 Firming On-River P4 Cost Considerations***

During a shortage to on-river P4 uses, these users may elect to request recovery through the AWBA, and exchange water with CAWCD. In effect, CAWCD will recover credits and the on-river P4 users will divert water that CAWCD left on the river. The on-river P4 users are obligated by existing agreements and statutes to pay the recovery costs borne by CAWCD and to reimburse the AWBA so that the AWBA may replace the storage credits. The cost components for recovery will reflect the mix of recovery methods used to firm P4 on-river uses. CAWCD's agreement with MCWA states that MCWA will pay the costs to deliver the storage credits to CAP customers. Some on-river P4 users may elect to evaluate alternatives to firming, such as paying for fallowing agricultural uses, to determine the most cost effective means to mitigate the impacts of shortage on their water supplies. Estimates of recovery cost components will be developed along with detailed recovery plans in the next step of the recovery planning process.

## **6.2 IMPLEMENTATION STEPS AND “GO/NO GO” DECISIONS**

The implementation steps necessary to move forward with recovery are: preparing detailed plans for each recovery concept, continuing water supply and demands tracking, and implementing recovery projects as necessary. Due to the possibility of shortages beginning in 2011, and the possible on-set of full interstate recovery for SNWA, it is anticipated that the first implementation decision - “go/no go” decision, will be necessary before 2011.

### ***6.2.1 Preparing Detailed Plans***

The next step in recovery planning is the preparation of detailed recovery plans for each conceptual plan. The detailed plans will define an optimal recovery capacity for each project as well as include a cost estimate for construction, operation, and maintenance of recovery facilities. The detailed plans will include feasibility level designs, a construction timeline, and an estimated timeline for permitting. In addition, the detailed plans will consider issues regarding long-term protection of stored water. Upon completion of the detailed plans, implementation decisions based on costs, timing, and capacity requirements may be made. Preparing detailed plans for ten recovery facilities may require significant investments by CAWCD, in terms of staff resources and consulting services. It is anticipated that the detailed plans will be completed in the 2009/10 timeframe.

### ***6.2.2 Implementing Recovery Projects - “Go/No Go” Decision***

Unless conditions in the Colorado River watershed change substantially before 2010, it is likely CAWCD will address implementation decisions for recovery projects prior to 2011. The “go/no go” decisions will require continuing updates of Colorado River supplies, CAP demands, recovery project development timelines, and recovery project cost components. The implementation decisions will be based on a ranking of projects to provide a balance of recovery alternatives across the CAWCD service area, and to insure efficient and cost-effective recovery alternatives are available. The timing of implementation decisions should allow sufficient time for permitting and construction to be completed so that recovery facilities are operational before shortages occur.

### ***6.2.3 Continuing Water Supply and CAP Demands Updates***

The timing and magnitude of CAP shortages is a function of Colorado River supplies, CAP demands, and non-CAP Colorado River demands. In addition, interstate recovery is based on requests by SNWA and MWD. Therefore, the needed recovery capacity is a dynamic target, as is the potential timing of shortages. Therefore, CAWCD will require continuing updates on the Colorado River water supply, CAP demands, and other recovery variables upon which to base implementation decisions. Recovery planning and implementation represents a long-term commitment both in staff resources and potentially in capital investments by CAWCD.



## **APPENDIX A: STAKEHOLDERS LIST**

The development of conceptual plans to recover stored water benefited greatly from contributions and input from many interested parties. The planning process is a cooperative effort with the Arizona Water Banking Authority members and staff, and interested stakeholders. CAWCD is grateful for the time and effort provided by all interested stakeholders. The entities that contributed to the conceptual plans are:

### **ARIZONA WATER BANKING AUTHORITY**

#### Authority Members:

Herb Guenther, Chairman	Maureen George, Vice Chairman
Tom Buschatzke, Secretary	John Mawhinney                      Gayle Burns

#### Authority Ex Officio Members:

The Honorable Jake Flake	The Honorable Lucy Mason
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#### Authority staff:

Kim Mitchell	Virginia O'Connell	Timothy J. Henley
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### **INTERESTED STAKEHOLDERS**

Arizona Department of Water Resources  
Institutional Policy Advisory Group – Tucson AMA  
Arizona Municipal Water Users Association  
Metropolitan Domestic Water Improvement District  
City of Tucson  
Salt River Project  
City of Phoenix  
East Valley Water Forum  
Central Arizona Irrigation and Drainage District  
Maricopa-Stanfield Irrigation and Drainage District  
Hohokam Irrigation and Drainage District  
Town of Marana  
City of Mesa  
City of Scottsdale  
Mohave County Water Authority  
Lake Havasu City  
Bullhead City  
Tucson Active Management Area – Groundwater Users Advisory Council  
Pinal Active Management Area – Groundwater Users Advisory Council  
Phoenix Active Management Area – Groundwater Users Advisory Council  
Global Water Company  
University of Arizona Water Resources Research Center  
Arizona Water Institute